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SECTION C Descriptions and Specifications

Background

The Naval Surface Warfare Center, Carderock Division (NSWCCD), Environmental Quality Department, Pollution Prevention Branch (Code 632), has recently been awarded an Office of Naval Research (ONR) sponsored Environmental Requirements Advanced Technology (ERAT) project. This project, entitled "Embedded Probe for Hazardous Material Shelf Life Assessment" is a three-year effort and the workload and diversity of technical requirements necessitates the establishment of a team of experts from within Government (NSWCCD), industry, and academia to meet project goals. This "team" consists of representatives from NSWCCD, McDermott Technology, Inc., and the Applied Research Laboratory at Penn State University, State College, PA. The objective of this project is to demonstrate a low-cost, portable embedded sensor and intelligent measurement system that can interrogate the contents of liquid hazardous materials (HAZMATs) containers in an effort to evaluate vital shelf state conditions. The need for this technology was precipitated by the fact that U.S. Navy Supply System administrators estimate that hundreds of tons of HAZMATs are being wastefully discarded due to premature disposal. In FY97, this translated to a total of \$230 million dollars for shelf life material disposals. Within the OPNAV User Requirement 3.I.11.b it is stated "expired HAZMATs are the largest single category of disposal for the Navy". Inadequate material inspection and extension procedures continue to hamper the pollution prevention objective. Although analytical tests can be conducted to evaluate materials for extended shelf life, most end-users are not qualified to conduct or evaluate results of such tests. Additionally, handling open containers of HAZMATs can be dangerous to the sailor and the environment. Shipping HAZMATs to qualified laboratories for analysis is time-consuming and costly. Shelf life coordinators estimate that the true savings that can be obtained by avoiding inappropriate disposal of HAZMATs is actually 10 times the purchase price of the discarded materials. This estimate includes the costs associated with storage, transport, disposal, and the restocking activities pursuant to the inevitable replenishing of the HAZMATs back into inventory. Hence, there is a need for a shelf life extension technology that can provide fast, reliable, economical, and non-invasive detection of HAZMAT shelf conditions.

Scope and Tasks

The Contractor shall provide scientific and technical expertise to NSWCCD, along with facilities necessary to support the tasks listed below. These tasks include the base contract with a two-month period of performance, and three options which will be exercised as stated below.

BASE:

Task 1: Business Cost Analysis

A business cost analysis (BCA) task shall be completed within the first 2 months of contract award. After completion of this task, a go/no go decision will be made by NSWCCD, Code 632 personnel. This task involves collecting cost data for manufacture of both the embedded and punch type probe designs, coupled with the monitoring system costs. These costs will be determined by using costs of similar commercial off-the-shelf items. Also, costs associated with current hazardous material disposal, which will be collected by NSWCCD personnel shall be used in this analysis. Additional supporting data may be accumulated during the analysis by NSWCCD for incorporation into BCA. A review shall be made of the cost to manufacture the proposed sensing system in order to determine whether they are greater than the savings to be realized by implementation. Option I shall be exercised upon successful demonstration of Task 1, and within one month of completion of the base period.

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The contractor will be required to assist in the acquisition of component cost information with emphasis on cost estimates as pertains to the anticipated sensing probe designs. Using this data, coupled with data collected by NSWCCD, the contractor shall assist NSWCCD personnel in production of the final BCA. Results of the contractor analyses are to be provided to NSWCCD as described in CRDL A001.

OPTION I:

Task 2: Laboratory Testing of Candidate Hazardous Materials

Samples of candidate hazardous materials for study will be provided to the contractor by NSWCCD. The contractor will be required to perform the appropriate number of experiments to allow collection of sufficient data toward refinement of the sensing probe designs. The goal of the experiments performed is to optimize the design of the sensor probes so as to enhance sensitivity to the material failure modes (i.e., oxidation, thermal degradation). Four paints have been selected for study by the Government; from these four paints at least one, and possibly two, will be selected for use in subsequent tasks (outlined in Option II). The contractor shall be provided samples of all four paints. The contractor shall perform in house laboratory experiments (dielectric and thermal measurements) on the samples supplied. Experiments to be performed must provide the data necessary to make a decision on the paint down selection for further testing. The down selection of the paint shall be completed by the Government, within 1 month of the exercise of Option I. In addition to the four paints, a lubricant sample shall also be provided by the Government for testing. The selection of the lubricant will be based on technical data delivered to NSWCCD personnel and will be identified within 1 month of the exercise of Option I. The Contractor will be consulted for technical guidance during this selection process. Laboratory-based testing of the down selected paint(s) and the lubricant sample shall be completed within 7 months of the exercise of Option I. Results of the contractor analyses are to be provided to NSWCCD as described in CRDL A001.

Task 3: Build Laboratory-based Sensor System

In support of Task 2, the contractor shall build a laboratory-based measurement system using commercial off-the-shelf technology. The system shall be capable of measuring dielectric, thermal, and electrochemical properties of the candidate HAZMATs samples provided to the contractor by NSWCCD. The unit to be built must be portable enough to allow use in field. The unit components shall consist of six sets of sensor probes, computer interface capabilities, system electronics, and necessary software programs. Results of the contractor analyses are to be provided to NSWCCD as described in CRDL A001.

Task 4: Process Raw Data Collected in Laboratory

The raw data collected in the laboratory shall be modeled and features extracted. The contractor is responsible for identifying and acquiring necessary software to model and compile data. Both the data and the features shall be made available to other members of the team via CD ROMs. Other analysis efforts such as pattern recognition and free volume analysis may need to be performed to help refine the sensor design. If these analyses are determined to be necessary, any software needs shall be identified and acquired by the contractor. It is anticipated that this task will be performed in concert with tasks 2 and 3, hence it shall be completed within 9 months of the exercise of Option I. Results of the contractor analyses are to be provided to NSWCCD as described in CRDL A001.

The exercise of Option II shall be determined by the availability of funding and may be exercised anytime during the performance of Option I.

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OPTION II:

Task 5: Continued Laboratory-based Testing, Data Collection and Processing

The laboratory-based testing toward an optimized sensing system, as described in Task 2, shall be continued and includes data collection and processing. The overall optimization is a reiterative process and it is therefore understood that a number of experiments, data collection, and data manipulation events need to be performed. The required end product of the laboratory-based testing is the fabrication of a minimum of six sets of optimized sensing probes that can be immersed into the candidate HAZMATs. This task shall be completed within 4 months after the exercise of Option II. Results of the contractor analyses are to be provided to NSWCCD as described in CRDL A001.

Task 6: Build Field Deployable Sensing Probes

Using data collected during the performance of Task 5 by both NSWCCD and the contractor, the team shall select the optimized sensor design(s) to be fabricated for field-testing. A mechanism for inserting the optimized sensor array into the field HAZMAT containers must be established in such a way as to not compromise container contents. A minimum of three sets of field-deployable, optimized sensing probes shall be fabricated. This task shall be completed within 6 months after the exercise of Option II. Results of the contractor analyses are to be provided to NSWCCD as described in CRDL A001.

Task 7: Participate in Field Demonstrations of Laboratory-Developed Sensing System

The contractor shall accompany other team members in the field to insert the field-deployable sensing probes and collect data. The contractor will also need to ship field samples back to their laboratory for final optimization of the sensing probes. The number and type of samples shall be determined when the field-testing is underway (dependant on Depot supply). The contractor shall assist other team members in the evaluation of the collected field data. This task shall be completed within 9 months after the exercise of Option II. Results of the contractor analyses are to be provided to NSWCCD as described in CRDL A001.

Task 8: Identification of final/optimized sensing probe

After the completion of Task 7, the contractor shall provide to NSWCCD the final, optimized sensor. Specifically, at a minimum, one probe configuration needs to be identified and fabricated. This task shall be completed within 12 months after the exercise of Option II. Results are to be provided to NSWCCD as described in CRDL A001 and CRDL A002.

The exercise of Option III shall be determined by the availability of funding and may be exercised anytime during the performance of Option I and/or Option II.

OPTION III:

Task 9: Manufacturer of Optimized Sensing Probe and Implementation into Packaging

This task requires the manufacture of the optimized sensor provided in Task 8. A depot and/or ship shall be identified by NSWCCD as the test platform. The contractor shall supply sufficient sensing probes to analyze samples targeted at those platforms. The contractor shall assist NSWCCD personnel in approaching the material

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manufacturers for implementation of sensing probes into packaging. This task shall be completed within 12 months of the exercise of Option III. Results of the contractor analyses are to be provided to NSWCCD as described in CRDL A001.

Task 10: Extension of Sensing Technology to Other Hazardous Materials and Applications

This task is a repeat of Tasks 2, 3, 4, 6, 7, 8 listed above but using additional hazardous materials which shall be provided to contractor by NSWCCD. The number of additional materials shall be no greater than three paints, two lubricants, and two greases. NSWCCD personnel reserve the right to make changes to the selection of materials, in consultation with the contractor, when platforms (as described in Task 9) are identified. This task shall be completed within 12 months of the exercise of Option III. Results of the contractor analyses are to be provided to NSWCCD as described in CRDL A001.

Technical Conferences

Contractor Personnel shall be available for informal meetings with NSWCCD Technical Personnel to be held as requested throughout the performance of this contract in order to discuss the direction, progress, and/or problems that occur. It is anticipated that two informal meetings per year shall be required. Travel requirements for these meetings are stated in paragraph 4.0.

Travel Requirements

Contractor personnel shall be required to travel throughout the course of the project. Travel shall consist of the following for one person: approximately 15 trips to NSWCCD; two trips to Norfolk, VA; 1 trip to San Diego, CA, and two trips to State College, PA.

5.0 Technical Data Requirements

The technical data requirements for tasks in Section 2.0, are presented in Section 7.0, and shown on attached DD Form 1423.

Monthly Status Reports (CRDL A001)

For all tasks described in Section 2.0, the Contractor shall provide a Status Report on a monthly basis that shall describe the technical and financial status of each task area. The report shall describe the work accomplished during each reporting period and its relationship to the statement of work, problems encountered, significant results, appropriate recommendations, and an outline of the work planned for the next reporting period. The report shall clearly indicate the monies expended during the reporting period, and cumulatively.

Technical Report (CDRL A002)

Technical reports will be prepared as interim reports and one final report. Each interim report should describe summary of progress on tasks performed during the corresponding fiscal year and the final report should summarize progress of entire project. Included in reports should be progress, milestones, delays in task completion and associated problems causing such delays, and future plans.

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The report form, format, and content shall conform as described in DI-MISC-80711, section 10.2. All reports shall be delivered both in camera-ready form and also in electronic form on diskette in Microsoft Word 2000 or compatible version of Microsoft Word.

The following technical reports will be prepared within the specified dates:

Interim Report #1, "FY00 Progress Report on Embedded Probe for Hazardous Material Shelf Life Assessment", due no later than 01 September 2000.

Interim Report #2, "FY01 Progress Report on Embedded Probe for Hazardous Material Shelf Life Assessment", due no later than 01 September 2001.

Final Report, "Final Report of Progress on Embedded Probe for Hazardous Material Shelf Life Assessment", due within 30 days after completion of contract.

6.0 Deliverables

Presentation materials in hard copy, electronic, and/or viewgraph format, shall be made available to the Government after the results of each task specified in Section 2.0 is realized, throughout performance of the contract.

7.0 Place of Performance

The primary place of performance is the contractor's facility in Lynchburg, VA.

8.0 Place of Delivery

The documentation to be provided hereunder shall be delivered to:

Naval Surface Warfare Center
Carderock Division
Attn: Mary Jo Bierberch, Code 632
9500 MacArthur Blvd.
West Bethesda, MD 20817-5700

9.0 Security Requirements

All work under this contract shall be UNCLASSIFIED.

10.0 Government Furnished Information/Materials (GFI/GFM)

If GFI is required to perform the tasking described in Section 2.0, NSWCCD, Code 632, shall provide the required information and materials throughout the period of performance on an as needed basis. It is anticipated that the contractor will need the in-house test plan, hence it shall be provided to contractor within 3 months of the exercise of Option I. If NSWCCD determines that input from the contractor is desired on data collected from the inhouse experiments, then that data shall be forwarded to contractor for review after collection and compilation.